



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification: Not classified	A2	(11) International Publication Number: WO 91/03147 (43) International Publication Date: 21 March 1991 (21.03.91)
(21) International Application Number: PCT/US90/06038 (22) International Filing Date: 22 October 1990 (22.10.90) (71) Applicant (for all designated States except US): WM. WRIGLEY JR. COMPANY [US/US]; 410 North Michigan Avenue, Chicago, IL 60611 (US). (72) Inventor; and (75) Inventor/Applicant (for US only) : YATKA, Robert, J. [US/US]; 8823 West 147th Street, Orland Park, IL 60462 (US). (74) Agents: SHURTZ, Steven, P. et al.; Willian, Brinks, Olds, Hofer, Gilson & Lione, NBC Tower, Suite 3600, 455 North Cityfront Plaza Drive, Chicago, IL 60611-5599 (US).		(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US. Published <i>Without international search report and to be republished upon receipt of that report.</i> <i>Before the expiration of the time limit referred to in Article 21(2)(a) on the request of the applicant.</i> <i>Without classification; title and abstract not checked by the International Searching Authority.</i>
(54) Title: METHOD OF CONTROLLING RELEASE OF STEVIOSIDE IN CHEWING GUM AND GUM PRODUCED THEREBY (57) Abstract <p>The present invention includes a method for producing a chewing gum with a delayed release stevioside sweetener, as well as the chewing gum so produced. The delayed release stevioside sweetener is obtained by physically modifying stevioside properties by coating and drying. Stevioside sweetener is coated by encapsulation, partially coated by agglomeration, entrapped by absorption, or treated by multiple steps of encapsulation, agglomeration, and absorption. The coated sweetener is then co-dried and particle sized to produce a release-modified stevioside high-intensity sweetener. When incorporated into the chewing gum, these particles are adapted to enhance the shelf stability of the sweetener and/or produce a delayed release when the gum is chewed.</p>		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MC	Monaco
AU	Australia	FI	Finland	MG	Madagascar
BB	Barbados	FR	France	ML	Mali
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Fasso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GR	Greece	NL	Netherlands
BJ	Benin	HU	Hungary	NO	Norway
BR	Brazil	IT	Italy	RO	Romania
CA	Canada	JP	Japan	SD	Sudan
CF	Central African Republic	KP	Democratic People's Republic of Korea	SE	Sweden
CG	Congo	KR	Republic of Korea	SN	Senegal
CH	Switzerland	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
DE	Germany, Federal Republic of	LU	Luxembourg	TG	Togo
DK	Denmark			US	United States of America

-1-

METHOD OF CONTROLLING RELEASE OF
STEVIOSIDE IN CHEWING GUM AND
GUM PRODUCED THEREBY

BACKGROUND OF THE INVENTION

The present invention relates to methods for producing chewing gum. More particularly the invention relates to producing chewing gum containing high-potency sweeteners which have been treated to control their release and enhance shelf-life stability.

In recent years, efforts have been devoted to controlling release characteristics of various ingredients in chewing gum. Most notably, attempts have been made to delay the release of sweeteners and flavors in various chewing gum formulations to thereby lengthen the satisfactory chewing time of the gum. Delaying the release of sweeteners and flavors can also avoid an undesirable overpowering burst of sweetness or flavor during the initial chewing period. On the other hand, some ingredients have been treated so as to increase their rate of release in chewing gum.

In addition, other efforts have been directed at perfecting the use of high-potency sweeteners within the chewing gum formulation, to thereby increase the shelf-life stability of the

-2-

ingredients, i.e. the protection against degradation of the high-potency sweetener over time.

One such high-potency sweetener is stevioside, which is approved overseas for use in food products and in chewing gum as a flavor and flavor enhancer. This high-potency sweetener gives chewing gum a fast, strong release that is not desirable. Methods of treating the high-potency sweetener to delay the release of sweetness in balance with the chewing gum flavor would therefore be a definite improvement.

The use of stevioside as a sweetening agent was noted by F. Bell et al. in a 1954 article in Chemistry And Industry titled "Stevioside: A Unique Sweetening Agent." Stevioside is extracted from the plant Stevia rebaudiana Bertoni as described by H. B. Wood, et al., "Stevioside I, The Structure Of The Glucose Moieties," J. Org. Chem., 20: 875-883 (1955). A solvent extraction method for isolating stevioside is disclosed in U.S. Patent No. 3,723,410. Besides the extraction of stevioside, a similar sweetener called rebaudioside is extracted from Stevia rebaudiana Bertoni as disclosed in U.S. Patent Nos. 4,082,858 and 4,361,697.

The use of stevioside as an artificial sweetener was disclosed in U.S. Patent No. 3,296,079 and improvements in its use were disclosed in U.S. Patent No. 4,219,571 and Japanese Patent Nos. 84-048059 and 84-102372. U.S. Patent No. 4,612,942 discloses extracts of Stevia rebaudiana Bertoni as having flavor enhancing properties.

Analogues of stevioside were disclosed in U.S. Patent Nos. 4,332,830, 4,353,889, 4,402,990, and 4,454,290.

Mixtures of stevioside with other sweeteners are disclosed in U.S. Patent Nos. 4,495,170 and

-3-

4,902,525, and Japanese Patent No. 85-075252. Mixtures with other materials are noted in Japanese Patent Nos. 84-183670 and 85-188035.

U.K. Patent No. 2,185,674 discloses combinations of thaumatin and stevioside (among other ingredients) to stimulate growth of farm animals.

Japanese Patent No. 87-079752 discloses a sweetener made from stevioside, rebaudioside and steviol and selective decomposition of the sweet components using enzymes. The sweetener is used in chewing gum. Japanese Patent No. 80-09177 discloses use of stevioside in chewing gum.

Other patents disclose how a sweetener like aspartame can be physically modified to control its release rate in chewing gum.

For example, U.S. Patent No. 4,597,970 to Sharma et al. teaches a process for producing an agglomerated sweetener wherein the sweetener is dispersed in a hydrophobic matrix consisting essentially of lecithin, a glyceride, and a fatty acid or wax having a melting point between 25°C and 100°C. The method disclosed uses a spray-congealing step to form the sweetener-containing matrix into droplets, followed by a fluid-bed second coating on the agglomerated particles.

U.S. Patent Nos. 4,515,769 and 4,386,106, both to Merrit et al., teach a two step process for preparing a delayed release flavorant for chewing gum. In this process, the flavorant is prepared in an emulsion with a hydrophilic matrix. The emulsion is dried and ground, and the resulting particles are then coated with a water-impermeable substance.

U.S. Patent No. 4,230,687 to Sair et al. teaches a process for encasing an active ingredient to achieve gradual release of the ingredient in a product such as chewing gum. The method described involves

-4-

adding the ingredient to an encapsulating material in the form of a viscous paste. High-shear mixing is used to achieve a homogeneous dispersion of the ingredient within the matrix, which is subsequently dried and ground.

U.S. Patent No. 4,139,639 to Bahoshy et al. teaches a process of "fixing" aspartame by co-drying (by spray drying or fluid-bed coating) a solution containing aspartame and an encapsulating agent, such as gum arabic, to thereby surround and protect the aspartame in the gum during storage.

U.S. Patent No. 4,384,004 to Cea et al. teaches a method of encapsulating aspartame with various solutions of encapsulating agents using various encapsulation techniques, such as spray drying, in order to increase the shelf-stability of the aspartame.

U.S. Patent No. 4,634,593 to Stroz et al. teaches a method for producing controlled release sweeteners for confections, such as chewing gum. The method taught therein involves the use of an insoluble fat material which is mix mulled with the sweetener.

SUMMARY OF INVENTION

The present invention includes a method for producing chewing gum with a modified high-potency sweetener, specifically stevioside, as well as the chewing gum so produced. The delayed release high-potency sweetener is obtained by modifying the sweetener by encapsulation, partial encapsulation or partial coating, entrapment or absorption with low water-soluble materials or water-insoluble materials. The procedures for modifying the sweetener include spray drying, spray chilling, fluid-bed coating, co-acervation, and other agglomerating and standard encapsulating techniques. The sweetener may also be ab-

-5-

sorbed onto an inert or water-insoluble material. The sweetener may be modified in a multiple step process comprising any of the processes or combination of processes noted. The sweetener, stevioside, may also be combined with other sweeteners including, but not limited to, sucrose, dextrose, fructose, maltose, maltodextrin, xylose, palatinose, or others that are considered bulk sweeteners, as well as polyols including but not limited to sorbitol, mannitol, xylitol, maltitol, lactitol, palatinit, and lycasin. The high-potency sweetener stevioside may also be combined with other high-potency sweeteners including, but not limited to, thaumatin, aspartame, acesulfame K, sodium saccharin, sucralose, alitame, cyclamate, glycyrrhizin and dihydrochalcones.

This sweetener, stevioside, when modified according to the present invention, gives a chewing gum having a controlled-release sweetener. A higher quantity of sweetener can be used without resulting in a high initial sweetness impact, but instead having a delayed sweetness release that is compatible with the delayed flavor release in chewing gum, giving a highly consumer-acceptable chewing gum product.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Stevioside is a high-potency sweetener which is about 300 times sweeter than sugar. The taste properties of stevioside are considered good. At concentrations usually used, stevioside has a rapidly perceptible sweet taste that does not linger, but has a slight licorice aftertaste.

Stevioside sweeteners, also called stevia diterpene glycosides (DTG), are the sweet extracts from Stevia rebaudiana Bertoni and include stevioside, steviolbioside, rebaudiosides A, B, C, D and E, dulcoside A, and complexes mixtures of these ingredi-

-6-

ents. Generally, available purified extracts consist of stevioside or rebaudioside A or combinations thereof. Stevioside is the main sweet glycoside and the other components are present in varying concentrations, depending on the extraction procedures and plant varieties used.

Stevioside is approved for use in chewing gum in Japan and Brazil, but is not approved as a food additive by the United States Food and Drug Administration. One manufacturer of stevioside is Inga Stevia Industrial, Ltd. of Brazil. Their distributor in the United States is Sun Up Foods, Inc. of Benton, Kentucky. A purified stevioside product, composed of mostly rebaudioside A and stevioside, is also available from the Stevia Company, Inc. of Arlington Heights, Illinois.

When stevioside is added to chewing gum at a level of about 0.005% to 0.5%, the sweetener gives chewing gum a fast, intense sweetness that leaves a slight licorice aftertaste. It would be considered a significant improvement to a chewing gum to have the stevioside sweetener release its sweetness more slowly as the flavor in the gum is released, thus balancing the overall taste perception. This would also slow the release of the licorice aftertaste, so that more sweetener could be used with less noticeable licorice aftertaste.

Stevioside can be added as a powder, as an aqueous solution, or dissolved in glycerine, propylene glycol, corn syrup, hydrogenated starch hydrolygate, or any other compatible aqueous solutions.

For aqueous solutions, an emulsifier can also be mixed in the solution with the stevioside sweetener and the mixture added to a chewing gum. A flavor can also be added to the sweetener/emulsifier mixture. The emulsion formed can be added to chewing

-7-

gum. Powdered stevioside may also be mixed into a molten chewing gum base during base manufacture or prior to manufacture of the gum. Stevioside may also be mixed with base ingredients during base manufacture.

Usage levels of stevioside in water or aqueous solvent is limited to its solubility in the aqueous solvent. For stevioside, solubility in water at 20°C is at least 40% (w/w) and increases with temperature. In most other aqueous solvents, like glycerine or propylene glycol, the solubility of stevioside is less than in plain water. Whether as a powder or dissolved in liquid, the amount of stevioside added to chewing gum of the present invention is about .005-0.5%. Preferably the range of stevioside in gum is about 0.01% to about 0.10%.

As stated previously, stevioside releases quickly from chewing gum during the early stages of mastication of the gum because of its high solubility in water. Physical modifications of the sweetener by encapsulation with another substrate will slow its release in chewing gum by reducing the solubility or dissolution rate of stevioside. Any standard technique which gives partial or full encapsulation of the stevioside sweetener can be used. These techniques include, but are not limited to, spray drying, spray chilling, fluid-bed coating and coacervation. These encapsulation techniques that give partial encapsulation or full encapsulation can be used individually or in any combination in a single step process or multiple step process. Generally, delayed release of sweetener is obtained in multistep processes like spray drying the sweetener and then fluid-bed coating of the resultant powder.

The encapsulation techniques here described are standard coating techniques and generally give

-8-

varying degrees of coating, from partial to full coating, depending on the coating composition used in the process. Also, the coating compositions may be susceptible to water permeation to various degrees. Generally, compositions that have high organic solubility, good film-forming properties and low water solubility give better delayed release of the sweetener. Such compositions include acrylic polymers and copolymers, carboxyvinyl polymer, polyamides, polystyrene, polyvinyl acetate, polyvinyl acetate phthalate, polyvinylpyrrolidone, and waxes. Although all of these materials are possible for encapsulation of stevioside sweetener, only food-grade materials should be considered. Two standard food-grade coating materials that are good film formers but not water soluble are shellac and Zein. Others which are more water soluble, but good film formers, are materials like agar, alginates, a wide range of cellulose derivatives like ethyl cellulose, methyl cellulose, sodium hydroxymethyl cellulose, and hydroxypropylmethyl cellulose, dextrin, gelatin, and modified starches. These ingredients, which are generally approved for food use, also give a delayed release when used as an encapsulant for stevioside. Other encapsulants like acacia or maltodextrin can also encapsulate stevioside, but give very little change in the release rate of stevioside in gum.

The amount of coating or encapsulating material on the sweetener stevioside also controls the length of time for its release from chewing gum. Generally, the higher the level of coating and the lower the amount of active stevioside, the slower the release of the sweetener during mastication. The release is generally not instantaneous, but gradual over an extended period of time. To obtain the desired sweetness release to blend with a gum's flavor

-9-

release, the encapsulant should be a minimum of about 20% of the coated sweetener. Preferably, the encapsulant should be a minimum of about 30% of the coated sweetener, and most preferably should be a minimum of about 40% of the coated sweetener. Depending on the coating material, a higher or lower amount of coating material may be needed to give the desired release of sweetener to balance sweetness release with flavor release.

Another method of giving a delayed release of the sweetener, stevioside, is agglomeration of the sweetener with an agglomerating agent which partially coats the sweetener. This method includes the step of mixing the sweetener and agglomerating agent with a small amount of water or solvent. The mixture is prepared in such a way as to have individual wet particles in contact with each other so that a partial coating can be applied. After the water or solvent is removed, the mixture is ground and used as a powdered, coated sweetener.

Materials that can be used as the agglomerating agent are the same as those used in encapsulation procedures mentioned previously. However, since the coating is only a partial encapsulation, and the stevioside sweetener is very water soluble, some agglomerating agents are more effective in delaying the sweetener release than others. Some of the better agglomerating agents are the organic polymers like acrylic polymers and copolymers, polyvinyl acetate, polyvinylpyrrolidone, waxes, shellac, and Zein. Other agglomerating agents are not as effective in giving the sweetener a delayed release as are the polymers, waxes, shellac and Zein, but can be used to give some delayed release. These other agglomerating agents include, but are not limited to, agar, alginates, a wide range of cellulose derivatives like ethyl cellu-

-10-

lose, methyl cellulose, sodium hydroxymethyl cellulose, hydroxypropylmethyl cellulose, dextrin, gelatin, modified starches, and vegetable gums like guar gum, locust bean gum, and carrageenin. Even though the agglomerated sweetener is only partially coated, when the quantity of coating is increased compared to the quantity of stevioside sweetener, the release of the sweetener can be delayed for a longer time during mastication. The level of coating used in the agglomerated product is a minimum of about 5%. Preferably the coating level is a minimum of about 15% and more preferably about 20%. Depending on the agglomerating agent, a higher or lower amount of agent may be needed to give the desired release of sweetener to balance sweetness release with flavor release.

The stevioside sweetener may be coated in a two-step process or multiple step process. The sweetener may be encapsulated with any of the materials as described previously and then the encapsulated sweetener can be agglomerated as described previously to obtain an encapsulated/agglomerated/sweetener product that could be used in chewing gum to give a delayed release of sweetener.

In another embodiment of this invention, stevioside sweetener may be absorbed onto another component which is porous and become entrapped in the matrix of the porous component. Common materials used for absorbing the sweetener include, but are not limited to, silicas, silicates, pharmsorb clay, spongelike beads or microbeads, amorphous sugars like spray-dried dextrose, sucrose, alditols, amorphous carbonates and hydroxides, including aluminum and calcium lakes, vegetable gums and other spray dried materials.

Depending on the type of absorbent material and how it is prepared, the amount of stevioside

-11-

sweetener that can be loaded onto the absorbent will vary. Generally materials like polymers or spongelike beads or microbeads, amorphous sugars and alditols and amorphous carbonates and hydroxides absorb an amount equal to about 10% to about 40% of the weight of the absorbent. Other materials like silicas and pharma-sorb clays may be able to absorb about 20% to about 80% of the weight of the absorbent.

The general procedure for absorbing the sweetener onto the absorbent is as follows. An absorbent like fumed silica powder can be mixed in a powder blender and an aqueous solution of the stevioside sweetener can be sprayed onto the powder as mixing continues. The aqueous solution can be about 5% to 30% stevioside solids, and higher solid levels may be used if temperatures up to 90°C are used. Generally water is the solvent, but other solvents like alcohol could also be used if approved for use in food. As the powder mixes, the liquid is sprayed onto the powder. Spraying is stopped before the mix becomes damp. The still free-flowing powder is removed from the mixer and dried to remove the water or other solvent, and then ground to a specific particle size.

After the stevioside sweetener is absorbed onto an absorbent or fixed onto an absorbent, the fixative/sweetener can be coated by encapsulation. Either full or partial encapsulation may be used, depending on the coating composition used in the process. Full encapsulation may be obtained by coating with a polymer as in spray drying, spray chilling, fluid-bed coating, coacervation, or any other standard technique. A partial encapsulation or coating can be obtained by agglomeration of the fixative/sweetener mixture using any of the materials discussed above.

-12-

The three methods of use to obtain a delayed release of stevioside sweetener are: (1) encapsulation by spray drying, fluid-bed coating, spray chilling and coacervation to give full or partial encapsulation, (2) agglomeration to give partial encapsulation and (3) fixation or entrapment/absorption which also gives partial encapsulation. These three methods, combined in any usable manner which physically isolates the stevioside sweetener, reduces its dissolvability or slows down the release of sweetener, are included in this invention.

Other methods of treating the stevioside sweetener to physically isolate the sweetener from other chewing gum ingredients may also have some effect on its release rate and stability. The stevioside sweetener may be added to the liquid inside a liquid center gum product. The center fill of a gum product may comprise one or more carbohydrate syrups, glycerin, thickeners, flavors, acidulants, colors, sugars and sugar alcohols in conventional amounts. The ingredients are combined in a conventional manner. The stevioside sweetener is dissolved in the center-fill liquid and the amount of stevioside sweetener added to the center-fill liquid is about 50 ppm to about 5000 ppm by weight of the entire chewing gum formula. This method of using stevioside sweetener in chewing gum can allow for a lower usage level of the sweetener, can give the sweetener a smooth release rate, and can reduce or eliminate any possible reaction of the sweetener with gum base, flavor components or other components, yielding improved shelf stability.

Another method of isolating stevioside sweetener from other chewing gum ingredients is to add stevioside to the dusting compound of a chewing gum. A rolling or dusting compound is applied to the

-13-

surface of chewing gum as it is formed. This rolling or dusting compound serves to reduce sticking to machinery as it is formed, reduces sticking of the product to machinery as it is wrapped, and sticking to its wrapper after it is wrapped and being stored. The rolling compound comprises stevioside sweetener in combination with mannitol, sorbitol, sucrose, starch, calcium carbonate, talc, other orally acceptable substances or a combination thereof. The rolling compound constitutes from about 0.25% to about 10.0%, but preferably about 1% to about 3% of weight of the chewing gum composition. The amount of stevioside sweetener added to the rolling compound is about 0.05% to about 20% of the rolling compound or about 5 ppm to about 2,000 ppm of the chewing gum composition. This method of using stevioside sweetener in the chewing gum can allow a lower usage level of the sweetener, can give the sweetener a more controlled release rate, and can reduce or eliminate any possible reaction of the sweetener with gum base, flavor components, or other components, yielding improved shelf stability.

Another method of isolating stevioside sweetener is to use it in the coating/panning of a pellet chewing gum. Pellet or ball gum is prepared as conventional chewing gum, but formed into pellets that are pillow shaped, or into balls. The pellets/balls can be then sugar coated or panned by conventional panning techniques to make a unique sugar coated pellet gum. The stevioside sweetener is very stable and highly water soluble, and can be easily added to a sugar solution prepared for sugar panning. Stevioside can also be added as a powder blended with other powders often used in some types of conventional panning procedures. Using stevioside sweetener isolates the sweetener from other gum ingredients and modifies its release rate in chewing gum. Levels of

-14-

use of stevioside may be about 100 ppm to about 5,000 ppm in the coating and about 50 ppm to about 2,000 ppm of the weight of the chewing gum product. The weight of the coating may be about 20% to about 50% of the weight of the finished gum product.

Conventional panning procedures generally coat with sucrose, but recent advances in panning have allowed the use of other carbohydrate materials to be used in the place of sucrose. Some of these components include, but are not limited to, dextrose, maltose, palatinose, xylitol, lactitol, palatinit and other new alditols or a combination thereof. These materials may be blended with panning modifiers including, but not limited to, gum arabic, maltodextrins, corn syrup, gelatin, cellulose type materials like carboxymethyl cellulose or hydroxymethyl cellulose, starch and modified starches, vegetable gums like alginates, locust bean gum, guar gum, and gum tragacanth, insoluble carbonates like calcium carbonate or magnesium carbonate and talc. Antitack agents may also be added as panning modifiers which allow the use of a variety of carbohydrates and sugar alcohols to be used in the development of new panned or coated gum products. Flavors may also be added with the sugar coating and with the stevioside sweetener to yield unique product characteristics.

Another type of pan coating would also isolate the stevioside sweetener from the chewing gum ingredients. This technique is referred to as film coating and is more common in pharmaceuticals than in chewing gum, but procedures are similar. A film like shellac, Zein, or cellulose-type material is applied onto a pellet-type product forming a thin film on the surface of the product. The film is applied by mixing the polymer, a plasticizer and a solvent (pigments are optional) and spraying the mixture onto the pellet

-15-

surface. This is done in conventional type panning equipment, or in more advanced side-vended coating pans. When a solvent like alcohol is used, extra precautions are needed to prevent fires and explosions, and specialized equipment must be used.

Some film polymers can use water as the solvent in film coating. Recent advances in polymer research and in film coating technology eliminates the problem associated with the use of solvents in coating. These advances make it possible to apply aqueous films to a pellet or chewing gum product. As stevioside sweetener is highly water soluble, it can be added to this aqueous film solution and applied with the film to the pellet or chewing gum product. The aqueous film or even the alcohol solvent film, in which stevioside may be dispersed, may also contain a flavor along with the polymer and plasticizer. By adding stevioside sweetener to the polymer/plasticizer/solvent system, either as an emulsion or solution, the sweetener can add sweetness to the flavor and a balanced flavor/ sweetness can be obtained. The stevioside sweetener can also be dissolved in the aqueous solvent and coated on the surface with the aqueous film. This will give a unique sweetness release to a film coated product.

The previously described encapsulated, agglomerated, or absorbed high-potency sweetener may readily be incorporated into a chewing gum composition. The remainder of the chewing gum ingredients are noncritical to the present invention. That is, the coated particles of high-potency sweetener can be incorporated into conventional chewing gum formulations in a conventional manner. Naturally, the preferred chewing gum formulation is a sugarless chewing gum. However, the high-potency sweeteners may also be used in a sugar chewing gum to intensify and/or extend

-16-

the sweetness thereof. The coated high-potency sweetener may be used in either regular chewing gum or bubble gum.

In general, a chewing gum composition typically comprises a water-soluble bulk portion, a water-insoluble chewable gum base portion and typically water-insoluble flavoring agents. The water-soluble portion dissipates with a portion of the flavoring agent over a period of time during chewing. The gum base portion is retained in the mouth throughout the chew.

The insoluble gum base generally comprises elastomers, resins, fats and oils, waxes, softeners and inorganic fillers. Elastomers may include polyisobutylene, isobutylene-isoprene copolymer and styrene butadiene rubber, as well as natural latexes such as chicle. Resins include polyvinylacetate and terpene resins. Fats and oils may also be included in the gum base, including tallow, hydrogenated and partially hydrogenated vegetable oils, and cocoa butter. Commonly employed waxes include paraffin, microcrystalline and natural waxes such as beeswax and carnauba. According to the preferred embodiment of the present invention, the insoluble gum base constitutes between about 5 to about 95 percent by weight of the gum. More preferably the insoluble gum base comprises between 10 and 50 percent by weight of the gum and most preferably about 20 to about 35 percent by weight of the gum.

The gum base typically also includes a filler component. The filler component may be calcium carbonate, magnesium carbonate, talc, dicalcium phosphate or the like. The filler may constitute between about 5 and about 60 percent by weight of the gum base. Preferably, the filler comprises about 5 to about 50 percent by weight of the gum base.

-17-

Gum bases typically also contain softeners, including glycerol monostearate and glycerol triacetate. Further, gum bases may also contain optional ingredients such as antioxidants, colors, and emulsifiers. The present invention contemplates employing any commercially acceptable gum base.

The water-soluble portion of the chewing gum may further comprise softeners, sweeteners, flavoring agents and combinations thereof. Softeners are added to the chewing gum in order to optimize the chewability and mouth feel of the gum. Softeners, also known in the art as plasticizers or plasticizing agents, generally constitute between about 0.5 to about 15.0 percent by weight of the chewing gum. Softeners contemplated by the present invention include glycerin, lecithin, and combinations thereof. Further, aqueous sweetener solutions such as those containing sorbitol, hydrogenated starch hydrolysates, corn syrup and combinations thereof may be used as softeners and binding agents in gum.

As mentioned above, the coated high-potency sweeteners of the present invention will most likely be used in sugarless gum formulations. However, formulations containing sugar are also within the scope of the invention. Sugar sweeteners generally include saccharide-containing components commonly known in the chewing gum art which comprise, but are not limited to, sucrose, dextrose, maltose, dextrin, dried invert sugar, fructose, levulose, galactose, corn syrup solids and the like, alone or in any combination.

The coated high-potency sweeteners of the present invention can also be used in combination with other sugarless sweeteners. Generally sugarless sweeteners include components with sweetening characteristics but which are devoid of the commonly known

-18-

sugars and comprise, but are not limited to, sugar alcohols such as sorbitol, mannitol, xylitol, hydrogenated starch hydrolysates, maltitol and the like, alone or in any combination.

Depending on the particular sweetness release profile and shelf-stability needed, the coated high-potency sweeteners of the present invention can also be used in combination with uncoated high-potency sweeteners or with high-potency sweeteners coated with other materials and by other techniques.

A flavoring agent may be present in the chewing gum in an amount within the range of from about 0.1 to about 10.0 weight percent and preferably from about 0.5 to about 3.0 weight percent of the gum. The flavoring agents may comprise essential oils, synthetic flavors, or mixture thereof including, but not limited to, oils derived from plants and fruits such as citrus oils, fruit essences, peppermint oil, spearmint oil, clove oil, oil of wintergreen, anise, and the like. Artificial flavoring components are also contemplated for use in gums of the present invention. Those skilled in the art will recognize that natural and artificial flavoring agents may be combined in any sensorally acceptable blend. All such flavors and flavor blends are contemplated by the present invention.

Optional ingredients such as colors, emulsifiers and pharmaceutical agents may be added to the chewing gum.

In general, chewing gum is manufactured by sequentially adding the various chewing gum ingredients to a commercially available mixer known in the art. After the ingredients have been thoroughly mixed, the gum mass is discharged from the mixer and shaped into the desired form such as by rolling into

-19-

sheets and cutting into sticks, extruding into chunks or casting into pellets.

Generally, the ingredients are mixed by first melting the gum base and adding it to the running mixer. The base may also be melted in the mixer itself. Color or emulsifiers may also be added at this time. A softener such as glycerin may also be added at this time, along with syrup and a portion of the bulking agent. Further portions of the bulking agent may then be added to the mixer. A flavoring agent is typically added with the final portion of the bulking agent. The coated sweetener of the present invention is preferably added after the final portion of bulking agent and flavor have been added.

The entire mixing procedure typically takes from five to fifteen minutes, but longer mixing times may sometimes be required. Those skilled in the art will recognize that many variations of the above described procedure may be followed.

Examples

The following examples of the invention and comparative examples are provided by way of explanation and illustration.

The formulas listed in Table 1 comprise various sugar-free formulas in which stevioside can be added to gum after it is dissolved in various aqueous type solvents.

TABLE 1
(Wt. %)

	<u>Example 1</u>	<u>Example 2</u>	<u>Example 3</u>	<u>Example 4</u>	<u>Example 5</u>
Sorbitol	49.7	49.6	49.3	49.3	49.3
Mannitol	8.0	8.0	8.0	8.0	8.0
Gum Base	25.5	25.5	25.5	25.5	25.5

-20-

TABLE 1 CONT'D
(Wt. %)

	<u>Example 1</u>	<u>Example 2</u>	<u>Example 3</u>	<u>Example 4</u>	<u>Example 5</u>
Glycerin	8.2	7.4	4.7	4.7	7.5
Hydro- genated Starch Hydroly- sates	6.8	6.8	6.8	6.8	4.0
Lecithin	0.2	0.2	0.2	0.2	0.2
Pepper- mint Flavor	1.45	1.45	1.45	1.45	1.45
Color	0.05	0.05	0.05	0.05	0.05
Liquid/ stevioside blend	0.1	1.0	4.0	4.0	4.0

Example 1 - stevioside powder can be added directly to the gum.

Example 2 - A 7.5 g portion of stevioside can be dissolved in 45.0 g water, making a 10.0% solution, and added to gum.

Example 3 - A 2.5 gram portion of stevioside can be dissolved in 97.5 grams of propylene glycol, making a 2.5% solution, and added to gum.

Example 4 - A 2.5 gram portion of stevioside can be dissolved in 97.5 grams of glycerin, making a 2.5% solution, and added to gum.

Example 5 - A 2.5 gram portion of stevioside can be dissolved in hot hydrogenated starch hydrolysates, making a 2.5% solution, and added to gum.

In the next examples of a sugar gum formulation, stevioside can be dissolved in water and emulsifiers can be added to the aqueous solution. Example solutions can be prepared by dissolving 7.5 grams of stevioside in 77.5 grams water and adding 15 grams of emulsifiers of various hydrophilic-lipophilic balance

-21-

(HLB) values to the solution. The mixtures can then be used in the following formulas.

TABLE 2

(Wt. %)

	<u>Example 6</u>	<u>Example 7</u>	<u>Example 8</u>	<u>Example 9</u>	<u>Example 10</u>	<u>Example 11</u>
Sugar	55.2	55.2	55.2	55.2	55.2	55.2
Base	19.2	19.2	19.2	19.2	19.2	19.2
Corn Syrup	12.9	12.9	12.9	12.9	12.9	12.9
Glycerine	0.9	0.9	0.9	0.9	0.9	0.9
Dextrose Monohydrate	9.9	9.9	9.9	9.9	9.9	9.9
Peppermint Flavor	0.9	0.9	0.9	0.9	0.9	0.9
Sweetener/ Emulsifier/ Water Mixture	1.0	1.0	1.0	1.0	1.0	1.0
	None	HLB=2	HLB=4	HLB=6	HLB=9	HLB=12

Examples 12-16 - The same as the formulations made in Examples 6-11, respectively, except that the flavor can be mixed together with the aqueous sweetener solution and emulsified before adding the mixture to the gum batch.

Stevioside sweetener can also be blended into various base ingredients. A typical base formula is as follows:

	<u>Wt. %</u>
Polyvinyl acetate	27
Synthetic rubber	13
Paraffin Wax	13
Fat	3

-22-

	<u>Wt. %</u>
Glycerol Monostearate	5
Terpene Resin	27
Calcium Carbonate Filler	<u>12</u>
	100%

The individual base components can be softened prior to their addition in the base manufacturing process. To the presoftened base component, stevioside can be added and mixed, and then the pre-softened base/sweetener blend can be added to make the finished base. In the following examples, stevioside can be mixed first with one of the base ingredients, and the mixed ingredient can then be used in making a base. The ingredients blended with stevioside can then be used at the levels indicated in the typical base formula above.

Example 17 - The terpene resin used to make the base is 98% polyterpene resin and 2% stevioside.

Example 18 - The polyvinyl acetate used to make the base is 98% low M.W. polyvinyl acetate and 2% stevioside.

Example 19 - The paraffin wax used to make the base is 96% paraffin wax and 4% stevioside.

Stevioside may also be added to an otherwise complete gum base.

Example 20 - 0.5% stevioside can be mixed with 99.5% of a gum base having the above listed typical formula. The stevioside can be added near the end of the process after all the other ingredients are added.

The samples of finished base made with stevioside added to different base components can then be evaluated in a sugar-type chewing gum formulated as follows:

-23-

TABLE 3

(Wt, %)
 (For examples 17, 18, 19, and 20)

Sugar	55.2
Base	19.2
Corn Syrup	13.4
Glycerine	1.4
Dextrose Monohydrate	9.9
Peppermint Flavor	<u>0.9</u>
	100%

The theoretical level of stevioside sweetener is 0.1% in the finished gum.

Using the following formulation of a sugar-free gum, a variety of encapsulated stevioside samples can be evaluated:

Table 4
 (Wt. %)

Sorbitol	49.4
Manitol	8.0
Gum Base	25.5
Glycerin	8.5
Lycasin	6.8
Lecithin	0.2
Peppermint Flavor	1.45
Color	0.05
Active Stevioside	0.10%

-24-

For spray drying, the solids level of an aqueous or alcoholic solution can be about 10-50%, but preferred levels are indicated in the examples listed.

Example 22 - A 90% shellac, 10% active stevioside powder mixture is obtained by spray drying an alcohol/shellac/stevioside solution at total solids of 10%.

Example 23 - A 50% shellac, 50% active stevioside powder mixture is obtained by spray drying an appropriate ratio alcohol/shellac/stevioside solution at 10% solids.

Example 24 - A 70% Zein, 30% active stevioside powder mixture is obtained by spray drying an alcohol/Zein/stevioside solution at 10% solids.

Example 25 - A 40% shellac, 60% active stevioside powder mixture is obtained by fluid-bed coating stevioside with an alcohol/shellac solution at 20% solids.

Example 26 - A 60% shellac, 40% active stevioside powder mixture is obtained by fluid-bed coating stevioside with an alcohol/shellac solution of 20% solids.

Example 27 - A 40% Zein, 60% active stevioside powder mixture is obtained by fluid-bed coating stevioside with an alcohol/Zein solution of 20% solids.

Example 28 - An 85% wax, 15% active stevioside powder mixture is obtained by spray chilling a mixture of molten wax and stevioside.

Example 29 - A 70% wax, 30% active stevioside powder mixture is obtained by spray chilling a mixture of molten wax and stevioside.

Example 30 - A 70% Zein, 30% active stevioside powder mixture is obtained by spray drying an aqueous mixture of stevioside and Zein dispersed in

-25-

an aqueous, high-pH (pH of 11.6-12.0) media at 10% solids.

Example 31 - A 20% Zein, 80% active stevioside powder mixture is obtained by fluid-bed coating stevioside with a an aqueous, high-pH (pH=11.6-12.0) Zein dispersion of 10% solids.

Example 32 - A 20% Zein, 20% shellac, 60% active stevioside powder mixture is obtained by spray drying an alcohol/shellac/stevioside mixture and then fluid-bed coating the spray dried product for a second coating of alcohol and Zein.

Example 22 to 32 would all give nearly complete encapsulation and would delay the release of stevioside sweetener when used in the sugarless gum formulation in Table 4. The higher levels of coating would give a longer delayed release of sweetener than the lower levels of coating.

Other polymers that are more water soluble would have less of an effect of delaying the release of the stevioside sweetener if used in the coating.

Example 33 - An 80% gelatin, 20% active stevioside powder mixture is obtained by spray drying a gelatin/stevioside solution at 10% solids.

Example 34 - A 30% hydroxypropylmethyl cellulose (HPMC), 70% stevioside powder mixture is obtained by fluid-bed coating stevioside with an aqueous solution of HPMC at 10% solids.

Example 35 - A 30% carboxymethyl cellulose, 70% active stevioside powder mixture is obtained by fluid bed coating stevioside with an aqueous solution of carboxy methyl cellulose at 10% solids.

Example 36 - A 50% maltodextrin, 50% active stevioside powder mixture is obtained by spray drying an aqueous solution of stevioside and maltodextrin at 20% solids.

-26-

Example 37 - A 40% gum arabic, 60% active stevioside powder mixture is obtained by fluid-bed coating stevioside with an aqueous solution of gum arabic at 20% solids.

The coated stevioside from Examples 33, 34 and 35, when used in the chewing gum formula in Table 4, would give a delayed release of sweetener. However, this delayed release would not be extended as much as in the previous examples (22-32), but would show some delayed release compared to the use of stevioside added directly to gum. The product coated with maltodextrin and gum arabic in Examples 36 and 37, when used in the gum formula in Table 4, would show no delay in sweetener release in chewing gum compared to stevioside added directly.

Stevioside could also be used in gum as an agglomerated sweetener to give delayed sweetness release. Agglomerated sweeteners can be prepared as in the following examples:

Example 38 - A 15% hydroxypropylmethyl cellulose (HPMC), 85% active stevioside powder mixture is prepared by agglomerating stevioside and HPMC blended together, with water being added, and the resulting product being dried and ground.

Example 39 - A 15% gelatin, 85% active stevioside powder mixture is made by agglomerating stevioside and gelatin blended together, with water being added, and the resulting product being dried and ground.

Example 40 - A 10% Zein, 90% active stevioside powder mixture is made by agglomerating stevioside with an alcohol solution containing 25% Zein, and drying and grinding the resulting product.

Example 41 - A 15% shellac, 85% active stevioside powder mixture is made by agglomerating

-27-

stevioside with an alcohol solution containing 25% shellac, and drying and grinding the resulting product.

Example 42 - A 20% HPMC, 80% active stevioside powder mixture is obtained by agglomerating an HPMC and stevioside mixture blended together, with water being added, and the resulting product being dried and ground.

Example 43 - A 20% Zein, 80% active stevioside powder mixture is obtained by agglomerating stevioside and Zein dissolved in high-pH water (11.6-12.0) at 15% solids, with the resulting product being dried and ground.

Example 44 - A 20% wax, 80% active stevioside powder mixture is obtained by agglomerating stevioside and molten wax, and cooling and grinding the resulting product.

Example 45 - A 15% maltodextrin, 85% active stevioside powder mixture is obtained by agglomerating a blend of stevioside and maltodextrin, then adding water, drying and grinding.

All of the above mixtures can be added to any of the following types of chewing gum formulas:

-28-

TABLE 5

(Wt. %)

	<u>Sugar</u>	<u>Sugar With Sorbitol</u>	<u>Sugarless With Water</u>	<u>Sugarless With Lycasin</u>	<u>Sugarless No Water</u>
Gum Base	19.2	19.2	25.5	25.5	25.5
Sugar	55.45	53.45	--	--	--
Sorbitol	--	2.0	53.7	49.4	52.2
Mannitol	--	--	8.0	8.0	12.0
Corn Syrup	13.1	13.1	--	--	--
Lycasin/ Sorbitol liquid	--	--	9.5 ^(a)	6.8 ^(b)	--
Glycerin	1.4	1.4	1.5	8.5	8.5
Lecithin	--	--	0.2	0.2	0.2
Dextrose Monohydrate	9.9	9.9	--	--	--
Flavor	0.9	0.9	1.5	1.5	1.5
Level of Active Stevioside	0.05	0.05	0.1	0.1	0.1

(a) liquid sorbitol (70% sorbitol, 30% water)

(b) hydrogenated starch hydrolyzate syrup

If each of the examples of agglomerated material (38-45) were evaluated in the formulations shown in Table 5, all samples except Example 45 with maltodextrin would give stevioside a delayed release. Samples using Zein, wax, and shellac would give the slowest release rate, whereas samples with HPMC and gelatin would give the next slowest release. Maltodextrin would give a release similar to the release rate of non-coated stevioside added directly to gum as a powder or liquid.

Partially coated or fully coated stevioside can also be used in sugar type gum formulations containing other sugars, such as in the following formulations A-G:

-29-

TABLE 6

(Wt. %)

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
Gum Base	19.2.	19.2	19.2	19.2	19.2	19.2	19.2
Sugar	59.4	50.4	49.4	49.4	50.4	52.4	52.4
Glycerin	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Corn Syrup	19.0	23.0	19.0	19.0	23.0	16.0	16.0
Dextrose	--	--	5.0	--	--	--	--
Lactose	--	--	--	--	5.0	--	--
Fructose	--	--	5.0	--	--	--	--
Invert Sugar	--	--	--	10.0	--	--	--
Maltose	--	--	--	--	--	10.0	--
Palatinose	--	--	--	--	--	--	10.0
Corn Syrup Solids	--	5.0	--	--	--	--	--
Peppermint Flavor	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Level of Active Stevioside	0.1	0.1	0.1	0.1	0.1	0.1	0.1

These formulations may also contain sugar alcohols such as sorbitol, mannitol, xylitol, lactitol, maltitol, palatinit, and lycasin or combinations thereof. Sugarless type gum formulations with partially coated or fully coated stevioside can also be made using various sugar alcohols, such as the following formulations H-P:

-30-

TABLE 7

(Wt. %)

	<u>H</u>	<u>I</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>	<u>P</u>
Base	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5
Sorbitol	53.9	46.9	41.9	41.9	41.9	41.9	36.9	37.9	46.9
Sorbitol Liquid/ Lycasin	17.0	14.0	6.0	--	5.0	--	--	6.0 ^(a)	18.0 ^(a)
Mannitol	--	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Maltitol	--	--	--	5.0	--	--	5.0	--	--
Xylitol	--	--	15.0	10.0	--	--	5.0	15.0	--
Lactitol	--	--	--	--	10.0	--	--	--	--
Palatinit	--	--	--	--	--	15.0	10.0	--	--
Glycerin	2.0	2.0	2.0	8.0	8.0	8.0	8.0	6.0	--
Flavor	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Level of Active Stevioside	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

(a) lycasin, all others use sorbitol liquid

All of these formulations in Table 6 and Table 7 which use the agglomerated stevioside as described in the examples (38-45) and in the previous encapsulated examples (22-35) would be expected to give a delayed release of sweetness compared to a product made by adding stevioside directly to gum as a powder or as liquid.

Multiple step agglomeration/encapsulation procedures can also be used in making release-modified sweeteners for use in the formulations in Tables 5, 6 and 7. Examples of multiple step treatments are here described:

Example 46 - Stevioside is spray dried with maltodextrin at 10% solids to prepare a powder. This powder is then agglomerated with a hydroxypropylmethyl cellulose (HPMC) in a ratio of 85/15 powder/HPMC, wet-

-31-

ted with water and dried. After grinding the resulting powder will contain about 68% active stevioside, 17% maltodextrin and 15% HPMC.

Example 47 - Stevioside is agglomerated with HPMC in a ratio of 85/15 sweetener/HPMC. After drying and grinding, the resulting powder is fluid-bed coated with an alcohol/shellac solution at about 20% solids to give a final product containing about 60% active stevioside, 10% HPMC, and about 30% shellac.

Example 48 - Stevioside is agglomerated with HPMC in a ratio of 85/15 Sweetener/HPMC. After drying and grinding, the resulting powder is agglomerated with a 15% solids, high-pH, aqueous solution of Zein to give a final product containing about 60% active stevioside, 10% HPMC, and 30% Zein.

Example 49 - Stevioside is spray dried with a 20% solution of gelatin. The spray dried product is then agglomerated with a 15% solids, high-pH, aqueous solution of Zein. The final product will contain about 50% active stevioside, 20% gelatin, and 30% Zein.

Example 50 - Stevioside is agglomerated with molten wax in a ratio of 85/15 sweetener/wax. When the mixture cools and is ground, it is fluid-bed coated with a 20% Zein - 80% alcohol solution, giving a final product containing 60% active stevioside, 10% wax and 30% Zein.

These examples 46-50, when used in any of the formulations noted in Tables 5, 6, and 7 above, give stevioside a delayed release and delayed sweetness. These multiple step procedures can actually give more delayed release than the single step processes. Multiple step processes of more than two steps may give even longer delayed release times, but may generally become less cost effective and less efficient. Preferably spray drying can be the first step, with addi-

-32-

tional steps of fluid-bed coating, spray chilling and agglomeration being part of the latter steps.

For absorption type examples, delayed release of stevioside sweetener is dependent on the type of absorbing material. Most materials like silicas, silicates, cellulose, carbonates, and hydroxides would be expected to give a more delayed release than amorphous sugar and sugar alcohols. Some examples:

Example 51 - A hot 25% solution of stevioside is sprayed onto a precipitated silica to absorb the sweetener. The mixture is dried and coated with a fumed silica. The final product is about 50% active stevioside.

Example 52 - A hot 25% solution of stevioside is sprayed onto a pharmasorb clay to absorb the sweetener. The mixture is dried and ground and gives a final product of about 80% clay and 20% active stevioside.

Example 53 - A 10% solution of stevioside is sprayed onto a microcrystalline cellulose powder to absorb the sweetener. The mixture is dried and ground and gives a product that is about 70% microcrystalline cellulose and 30% active stevioside.

Example 54 - A 10% solution of stevioside is sprayed onto a high absorption starch to absorb the sweetener. The mixture is dried and ground and gives a product that is about 80% starch and 20% active stevioside.

Example 55 - A 10% solution of stevioside is sprayed onto a calcium carbonate powder to absorb the sweetener. The mixture is dried and ground and gives a product of about 90% calcium carbonate and 10% active stevioside.

Example 56 - A hot 25% solution of stevioside is sprayed onto a highly absorptive dextrose material to absorb the sweetener. The mixture is dried and

-33-

ground and gives a product of about 80% dextrose and 20% active stevioside.

Example 57 - A hot 25% solution of stevioside is sprayed onto a sorbitol powder to absorb the material. The mixture is dried and ground and gives a product of about 90% sorbitol and 10% active stevioside.

The samples prepared in examples 51-57 can be used in gum formulations as noted in Tables 5, 6, and 7. Those preparations which have stevioside absorbed onto a material that is not water soluble are expected to give a delayed release of stevioside sweetener.

Another modification or absorption technique is to dry the stevioside together with a sugar or sugar alcohol, or resolidify the sweetener with sugar or sugar alcohol after both are mixed together in a molten state.

Example 58 - Stevioside is added to molten sorbitol in a ratio of 90 parts sorbitol to 10 parts stevioside. After mixing, the blend is cooled and ground.

Example 59 - Stevioside is added to molten dextrose in a ratio of 90 parts dextrose to 10 parts stevioside. After mixing, the blend is cooled and ground.

Example 60 - 4% Stevioside is dissolved in 96% high fructose corn syrup. The mixture is evaporated to a low moisture and ground.

The product of examples 58-60 may be added to the gum formulations shown in Tables 5, 6 and 7.

Many of the examples listed are single step processes. However, more delayed release of the stevioside sweetener may be obtained by combining the various processes of encapsulation, agglomeration, absorption, and entrapment. Any of the preparations made in Examples 51-60 can be further treated in fluid-bed

-34-

coating, spray chilling, or coacervation processes to encapsulate the product, and can be agglomerated with various materials and procedures in a variety of multiple step processes.

The stevioside sweetener may also be used with a variety of other high-intensity sweeteners and blended together before encapsulation, agglomeration, absorption, and entrapment. Some examples are:

Example 61 - Stevioside and aspartame are blended together in a 1/2 ratio as a powder. This mixture is then spray chilled with wax in a ratio of 60/40 mixture/wax to obtain a powder containing 20% stevioside, 40% aspartame, and 40% wax.

Example 62 - Stevioside and thaumatin in a 9/1 ratio are dissolved in water with a 10% solution of gelatin and spray dried. This spray dried powder is then agglomerated with a high-pH aqueous 15% Zein solution. The mixture is dried and ground and gives a product containing 45% stevioside, 5% thaumatin, 35% gelatin, and 15% Zein.

Example 63 - Stevioside and alitame in a 4/1 ratio are prepared in a hot 10% solution. This solution is sprayed onto a high absorption silica powder. The mixture is dried, ground and fluid-bed coated with an alcohol/shellac mixture, giving a product that contains 32% stevioside, 8% alitame, 40% silica, and 20% shellac.

Example 64 - Stevioside and sodium cyclamate in a 1/3 ratio are blended together as a powder and then agglomerated with water and hydroxypropylmethyl cellulose (HPMC). This blend is dried, ground and agglomerated further with a high-pH, aqueous 15% solution of Zein to obtain a product containing 51% sodium cyclamate, 17% stevioside, 12% HPMC and 20% Zein.

Example 65 - Sucralose and stevioside in a 1/2 ratio are blended together as a powder and fluid-

-35-

bed coated with a solution of 25% shellac in alcohol. The coated product is agglomerated further with water and hydroxypropylmethyl cellulose (HPMC) to obtain a product containing 20% sucralose, 40% stevioside, 25% shellac, and 15% HPMC.

Example 66 - Stevioside and sodium saccharin in a ratio of 1/1 are blended together as a powder and fluid bed coated with a solution of 25% shellac in alcohol. The coated product is agglomerated further with water and hydroxypropylmethyl cellulose (HPMC) to obtain a product containing 30% stevioside, 30% sodium saccharin, 25% shellac, and 15% HPMC.

If the blends of stevioside and other high-intensity sweeteners of Examples 61-66 are tested in gum formulations such as those noted in Tables 4, 5, 6 and 7, a significant delayed release of the sweetener and sweetness should be expected. This delayed release would improve the quality of flavor giving it the impression of a longer lasting flavor. Due to the synergistic effects of some of the sweetener combinations in Examples 61-66, less total sweetener can be used to give the same sweetness level as the single delayed release stevioside sweetener.

Stevioside may also be combined with other high intensity sweetener without encapsulation, agglomeration, or absorption and used in chewing gum, as in the following examples:

Example 67 - A combination of stevioside and aspartame can be used in the formulas listed in Tables 5, 6, and 7 by adjusting the formulas to contain 0.05% stevioside and 0.10% aspartame.

Example 68 - A combination of stevioside and thaumatin can be used in the formulas listed in Tables 5, 6, and 7 by adjusting the formulas to contain 0.18% stevioside and 0.02% thaumatin.

-36-

Example 69 - A combination of stevioside and sodium cyclamate can be used in the formulas listed in Tables 5, 6, and 7 by adjusting the formulas to contain 0.05% stevioside and 0.15% sodium cyclamate.

Example 70 - A combination of stevioside and acesulfame K can be used in the formulas listed in Tables 5, 6, and 7 by adjusting the formulas to contain 0.05% stevioside and 0.10% acesulfame K.

Example 71 - A combination of sucralose and stevioside can be used in the formulas listed in Tables 5, 6, and 7 by adjusting the formulas to contain 0.05% sucralose and 0.10% stevioside.

Example 72 - A combination of stevioside and sodium saccharin can be used in the formulas listed in Tables 5, 6 and 7 by adjusting the formulas to contain 0.05% stevioside and 0.05% sodium saccharin.

Example 73 - A combination of stevioside and glycyrrhizin can be used in the formulas listed in Tables 5, 6, and 7 by adjusting the formulas to contain 0.25% glycyrrhizin and 0.05% stevioside.

The formulations of Examples 68-73 do not give a delayed release action except for those sweeteners which normally have a slow release. Some of these sweetener combinations may be synergistic, in which case less total sweetener may be needed to give the same sweetness level as a single sweetener.

-37-

I CLAIM:

1. A method for producing chewing gum with stevioside comprising the steps of:

- a) mixing a quantity of stevioside with a spray drying solvent and an encapsulating material;
- b) spray drying the mixture in such a way as to encapsulate the stevioside; and
- c) adding a quantity of the spray dried material to a chewing gum formulation to provide a stevioside level in the gum of from 0.005% to 0.5%.

2. The method of Claim 1 wherein the solvent is selected from the group consisting of alcohol and water.

3. The method of Claim 1 wherein the encapsulating material is selected from the group consisting of shellac and Zein.

4. The method of Claim 1 wherein an additional high-potency sweetener selected from the group consisting of aspartame, alitame, salts of acesulfame, cyclamate and its salts, saccharin and its salts, sucralose, thaumatin, monellin, dihydrochalcone, glycyrrhizin and combinations thereof is mixed in the spray drying mixture in combination with the stevioside.

5. A chewing gum made according to the method of Claim 1.

6. The method of Claim 1 wherein the stevioside is selected from the group consisting of stevioside, steviolbioside, rebaudiosides A, B, C, D and E, dulcoside A, and complex mixtures thereof, from extracts from Stevia rebaudiana Bertoni.

-38-

7. A method for producing chewing gum with stevioside comprising the steps of:

- a) fluid-bed coating stevioside with a solution of an encapsulating material and a solvent;
- b) drying said fluid-bed coated material; and
- c) adding a quantity of the fluid-bed coated material to a chewing gum formulation to provide a stevioside level in the gum formulation of from about 0.005% to about 0.5%.

8. The method of Claim 7 wherein the solvent is selected from the group consisting of alcohol and water.

9. The method of Claim 7 wherein the encapsulating material is selected from the group consisting of shellac and Zein.

10. The method of Claim 7 wherein an additional high-potency sweetener selected from the group consisting of aspartame, alitame, salts of acesulfame, cyclamate and its salts, saccharin and its salts, sucralose, thaumatin, monellin, dihydrochalcone, glycyrrhizin, and combinations thereof is mixed in the spray drying mixture in combination with the stevioside.

11. A chewing gum made according to the method of Claim 7.

12. The method of Claim 7 wherein the stevioside is selected from the group consisting of stevioside, steviolbioside, rebaudiosides A, B, C, D and E, dulcoside A and complex mixtures thereof, from extracts from Stevia rebaudiana Bertoni.